



# A STUDY ON 7<sup>TH</sup> GRADE STUDENTS' MISCONCEPTIONS ON THE UNIT OF "SIMPLE ELECTRIC CIRCUITS"

Özlem ÇELENK GÜÇLÜER

Balıkesir University

## ABSTRACT

The aim of this study was to determine the misconceptions of 7<sup>th</sup> grade students about the unit of "Simple Electric Circuits" in the year 2018-2019. For this purpose, open questions and interviews were directed at 42 7<sup>th</sup> grade students. As a result of the analysis of data obtained, it was determined that the primary school students have various misconceptions about circuits, serially parallel circuits, bulbs, electric current. Some of the misconceptions; "bulbs connected in parallel give better light than those connected in series", "thick wires have lower resistance in a circuit because the charges have more space", "in serial circuits the bulbs are placed next to each other" and "electrical charge flows at very high speeds". Some suggestions were recommended by the help of the findings of this study.

**KEYWORDS:** Misconceptions, Primary Education, Science and Technology Textbooks, Simple Electric Circuits.

## I. INTRODUCTION:

Education is a process of changing some behaviors (Demirel, 2006: 6). One of the most important goal of the science education is to answer the questions and happenings in our environment. In our age, individuals are supposed to get the information they need, have the ability of scientific thinking by producing new information and make the technology usable in daily life (MEB, 2011). Students should improve the information, understanding, attitude and value about the science, they should progress their ability of searching, solving problem, making decision. And in order to get them some basic skills in this field, individuals must start their science education in primary schools (Tatar, 2006).

Science is the knowledge we gain by training the answers about things and happenings in universe, (Morgil, 1990: 21). Ayas and the others (1994) definite the science as a multidisciplinary to explore the relationship between living and non-living things.

Subjects of Science and Technology courses consist of various concepts and the relations among them. Concepts can be divided into two groups as visible concepts and invisible concepts (Atılğanlar, 2014). Misconceptions, which are defined as explaining a concept in a different form than the scientists could accept, are to be avoided by means of meaningful learning (Aydın, Balım, 2009). Before science lessons students have some beliefs about science. In science literature these beliefs are called as, "pre-concepts", "alternative conceptions", "misconceptions", "children's scientific instincts", "children's science", "general sense concepts", "spontaneous knowledge" (Gülçiçek, Yağbasan, 2004). The basic reasons of misconceptions can be arranged as; student factor; (lack of pre-knowledge, prejudices, lack of motivation and interest, using daily talking language in scientific subjects), teacher factor; (insufficient concept knowledge, wrong classifications of the concepts, overrate the details.) and text books factor; (teaching order, containing too much mistake and wrong knowledge, lack of shapes and examples, the lack of the connection of titles) (Aşçı, Özkan, Tekkaya, 2001).

The probability of changing misconceptions in further years decreases because of the difficulty of determining the misconceptions of students' when it occurs (Eyidoğan, Güneysu, 2002). In our country some researches were made to determine misconceptions in science in last years (Eryılmaz, Tatlı, 1999; Koray, Bal, 2002; Cardak, 2009; Bahar, 2003).

The aim of this study is to determine the 7<sup>th</sup> grade students' misconceptions about the unit of "Simple Electric Circuits".

## II. METHOD:

For determining and analyzing misconceptions concept maps, concept tests, open ended questions, negotiations and combinations of these method can be used (Schmidt, 1997).

This research was carried out in 2018 - 2019 academic year among 42, 7<sup>th</sup> grade students attending İsmet Yorgancılar primary school in İzmir. 21 of the participants were female and 21 were male. The students participating in the study were given a form which contains open-ended questions about the unit of "Simple Electric Circuits". During the interview, questions parallel with the misconceptions, such as why and how were directed at the students. These questions included, for example: "you state that wire is made of plastic; why? And "you state that if a circuit is broken energy goes off into the air; why? The collected data from the students was analyzed by researcher. The misconceptions gathered from the answers to the open questions were separated into five different sub-units: electric current, serial parallel circuits, bulbs, resistance and batteries.

## III. DISCUSSION:

To prevent the misconceptions which hinder learning these advices could be suggested: from the beginning of the primary education students' conceptual changes must be searched and the reasons of learning difficulties and misconceptions should be determined. Before the unit the misconceptions about that unit must be investigated and prevent the occurring of these misconceptions some worksheets and activities should be designed. Science and technology text books must be examined carefully and the texts which can cause misconceptions should be eliminated.

As seen table 7th grade students have a lot of misconceptions about the "Simple Electric Circuits" unit. These misconceptions can be originated from the learning environment (family, backgrounds etc) or they can be derived from the mistakes which are included in text books. The data's which gained in this search get along with the results of other studies. (Koray, Bal, 2002; Dikmenli, Çardak, Turkmen, 2002).

## IV. FINDINGS:

When the answers which were given to open ended questions about the unit "Simple Electric Circuits" were analyzed, it was found that the students have important problems about the unit. The misconceptions which were determined by the answers of the open ended questions is shown as below.

**Table 1: Students' misconceptions, numbers and frequencies about the unit of "Simple Electric Circuits"**

| Sub-unit  | Misconception                                  | f  | %  |
|-----------|--|----|----|
| Batteries | Batteries contain electricity.                 | 18 | 42 |
|           | Batteries are constant current sources         | 14 | 33 |
|           | Batteries are not recyclable.                  | 32 | 76 |
|           | Batteries are the most highly recycled product | 36 | 85 |
|           | Batteries are a source of clean energy.        | 24 | 57 |
|           | Dead batteries can have an afterlife.          | 18 | 42 |

|                            |  |    |    |
|----------------------------|--|----|----|
| Bulbs                      | bulbs connected in parallel give better light than those connected in series                 | 16 | 38 |
|                            | "no bulb lights on if the switch is off"   | 20 | 47 |
|                            | Different coloured wires affect how the circuit works.                                       | 24 | 57 |
| Resistance                 | Thick wires have lower resistance in a circuit because the charges have more space.          | 30 | 71 |
|                            | Charges slow down as they go through a thin piece of wire                                    | 33 | 78 |
|                            | Wire is made of plastic  | 36 | 85 |
|                            | Electricity comes out of both sides of the battery and leads to both sides of the component. | 22 | 52 |
| Serially parallel circuits | In serial circuits the bulbs are placed next to each other                                   | 26 | 61 |
|                            | In parallel circuit the bulbs are arranged above and below                                   | 39 | 92 |
|                            | Serially circuits are always economical  | 20 | 47 |
| Current                    | Current decreases when it passes through the bulb  | 27 | 64 |
|                            | Current, voltage and electricity are all the same thing.                                     | 16 | 38 |
|                            | If a circuit is broken, energy goes off into the air.  | 29 | 69 |
|                            | Electrical charge flows at very high speeds  | 30 | 71 |

As seen at the table 1 students have major misconceptions about Simple Electric Circuits. The most seen misconceptions are "bulbs connected in parallel give better light than those connected in series", "thick wires have lower resistance in a circuit because the charges have more space", "in serial circuits the bulbs are placed next to each other" and "electrical charge flows at very slow speeds. In fact, electric flows high speed. We cannot understand an electric current serial or parallel by their places. Another wrong belief: If a circuit is broken, energy goes off into the air. In fact, it electric do not goes off the air. There is no relationship between wire color amount of the electric.

## V. CONCLUSION:

At the end of the study it was determined that students have some understanding difficulties and develop some alternative conceptions at the unit of "Simple Electric Circuits" which is one of the difficult units in science lessons. Consequently, it was seen that students have important misconceptions at Batteries, bulbs, Serially parallel circuits and resistance generally.

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